Diagnosing Sneaker Wave Threat

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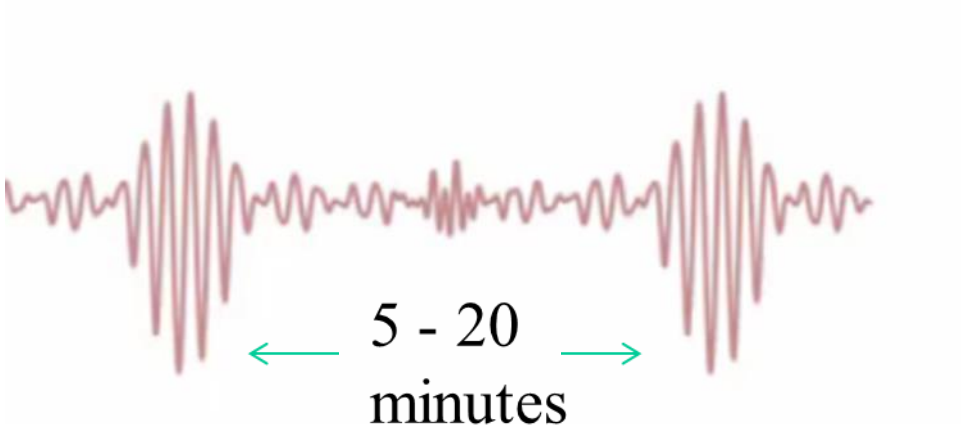
A Sneaker Wave is a wave running up on shore significantly farther than any wave in at least the previous five minutes, such that it is a surprise to the casual observer.

Mavericks Sneaker Wave by Jon Sandstrom

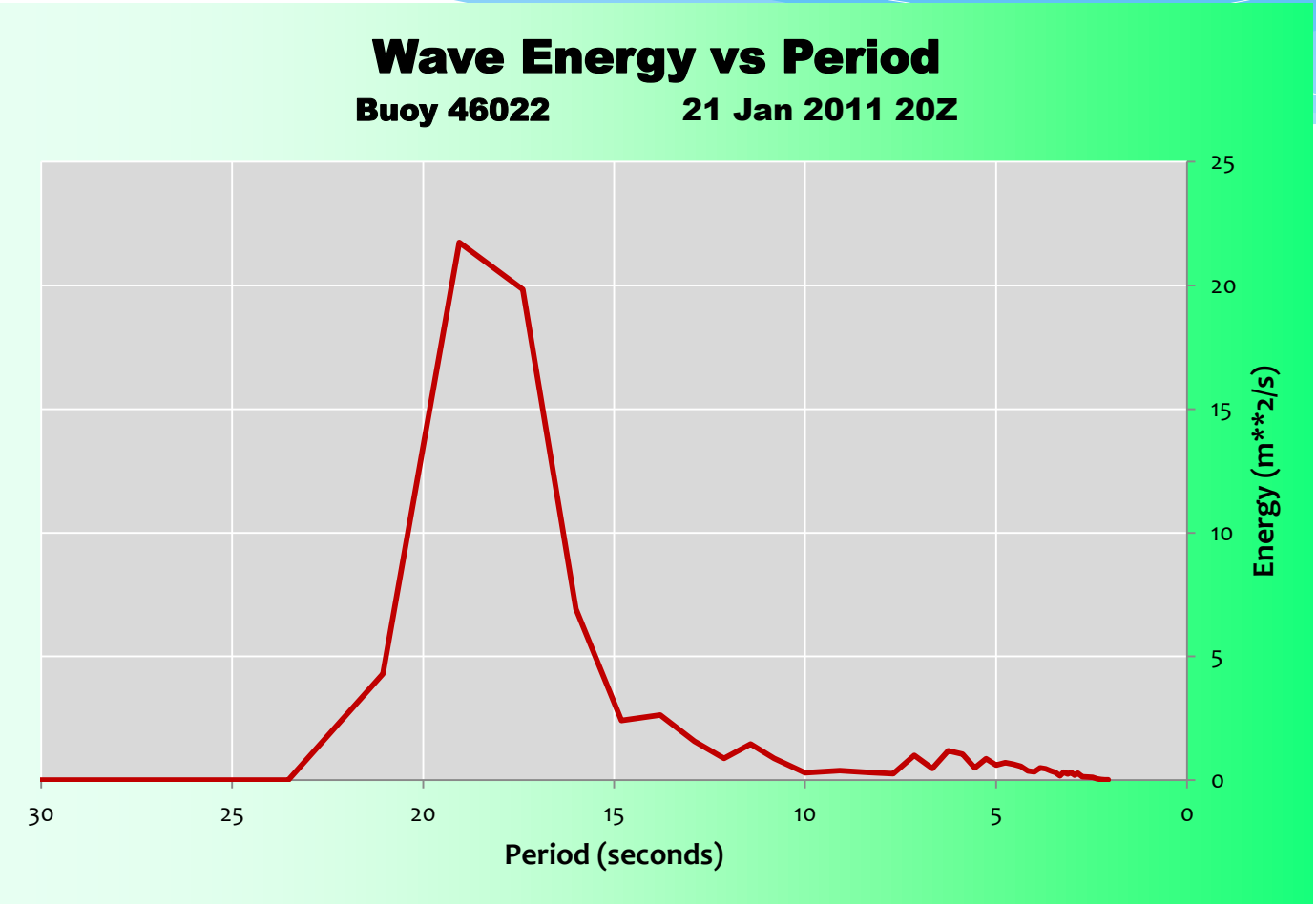
The Classic Case of Sneaker Waves

as suggested by Nicolini / Aylward

Based on the idea of alternate periods of Destructive/Constructive Interference

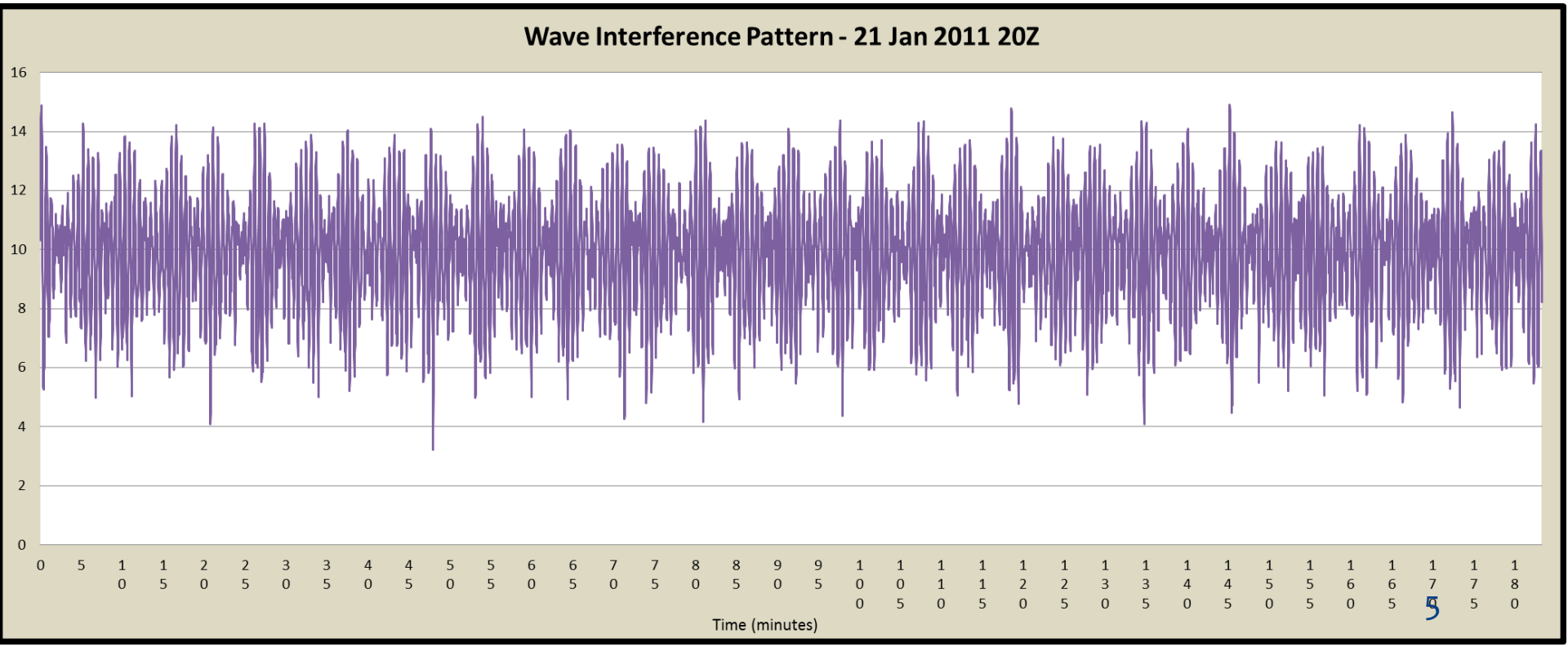


The Classic Case in a Wave Energy vs Period Plot



What does the actual Wave Interference pattern look like?

3 hours worth of projected interference…



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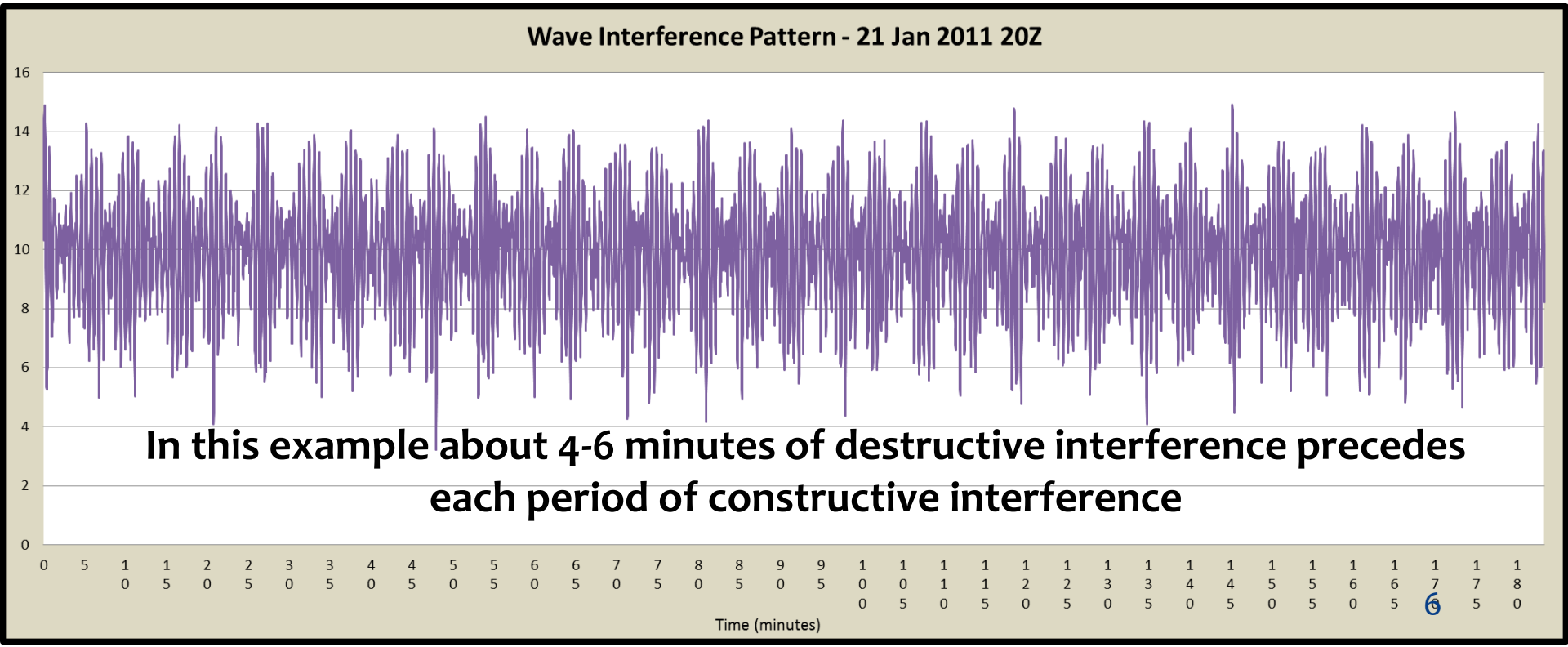
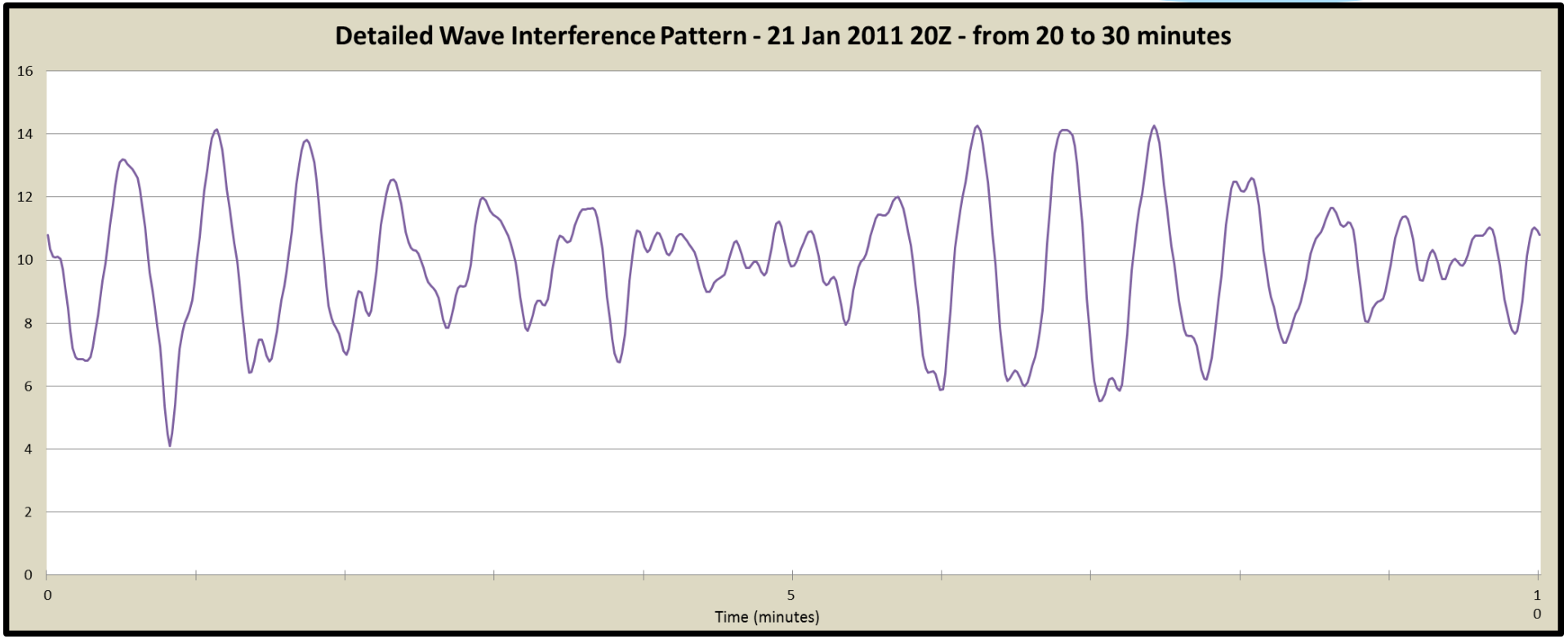


A detailed look at 10 minutes of the the interference pattern…



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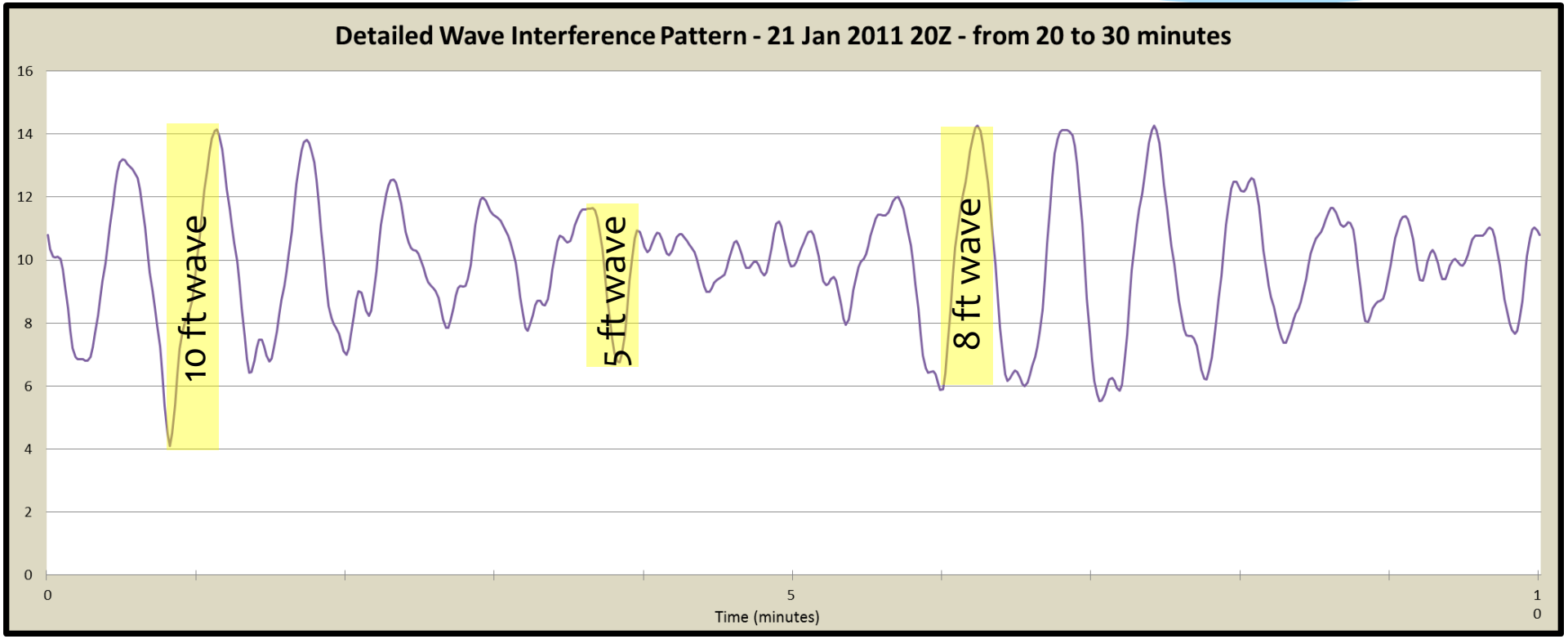


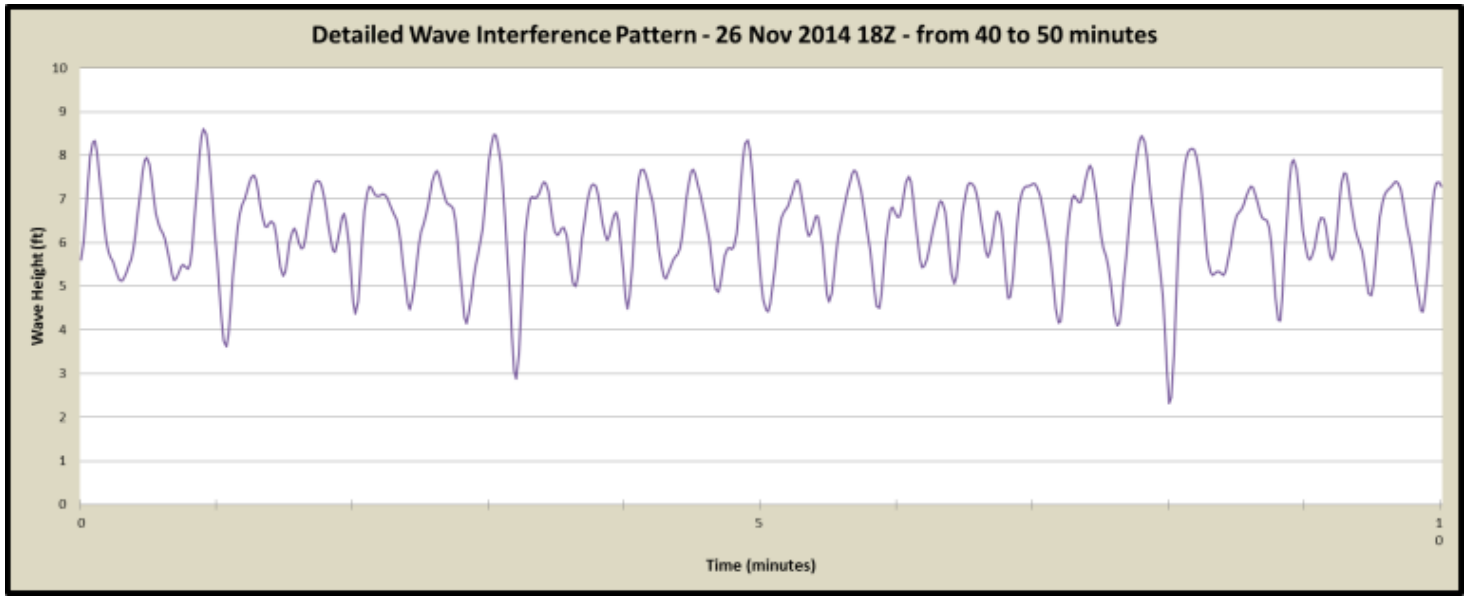
Putting a number on it

Objectively assessing sneakers…

Putting a number on it

Charts are analyzed by:

Over a period of 3 hours, searching all 4 minute intervals and assigning a peak wave height to each interval



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Charts are analyzed by:

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Checking subsequent 30 second periods and finding the peak wave height to each of those periods

Putting a number on it

Charts can then be analyzed by:

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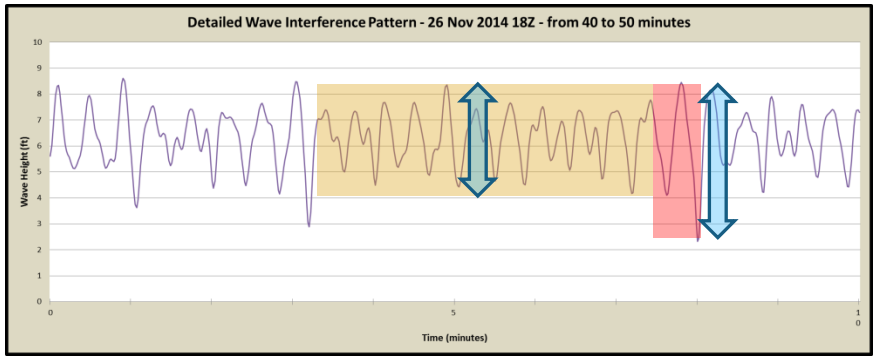
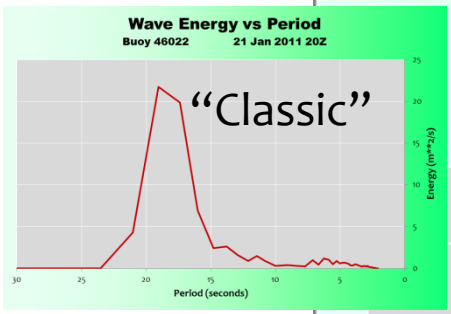
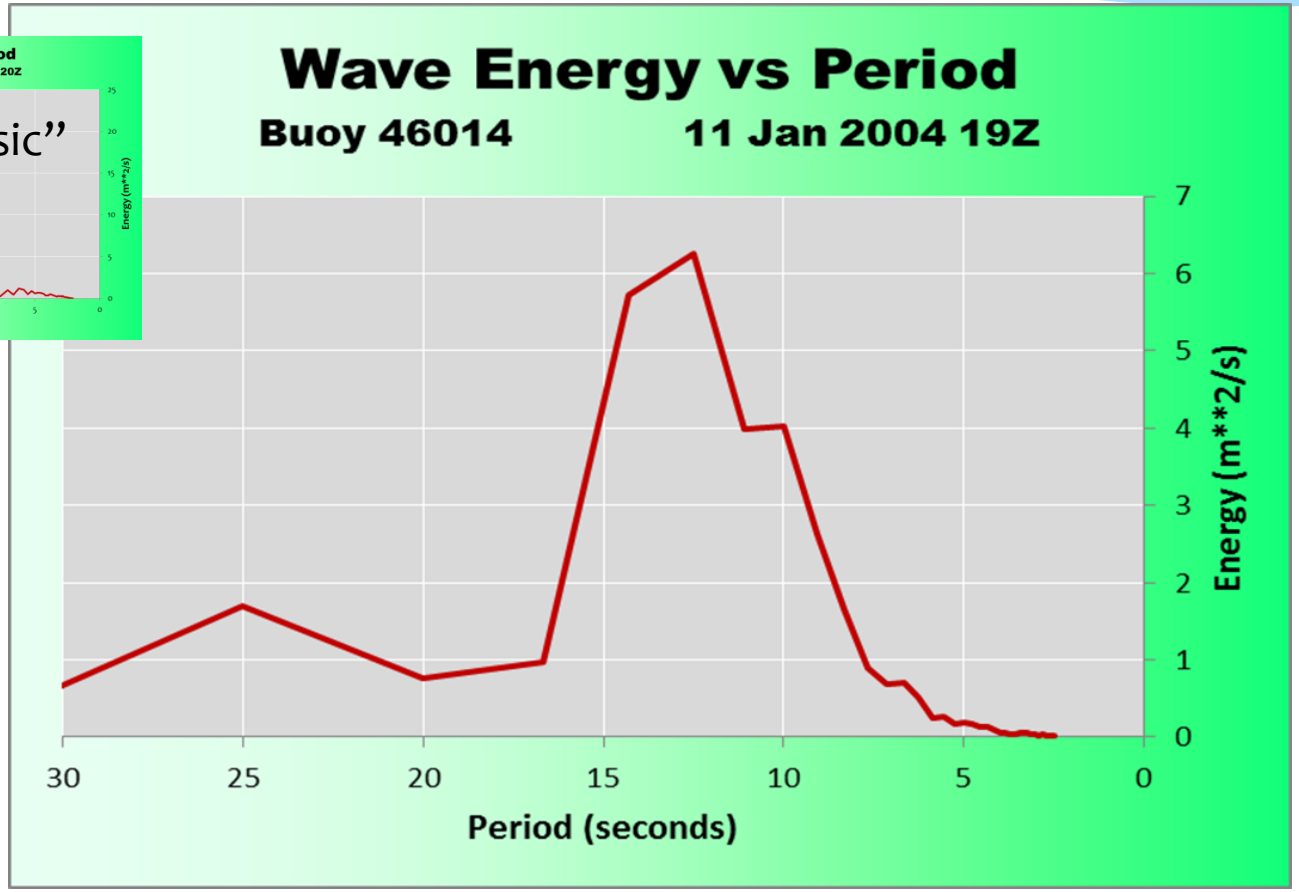
Finding the greatest increase in wave height



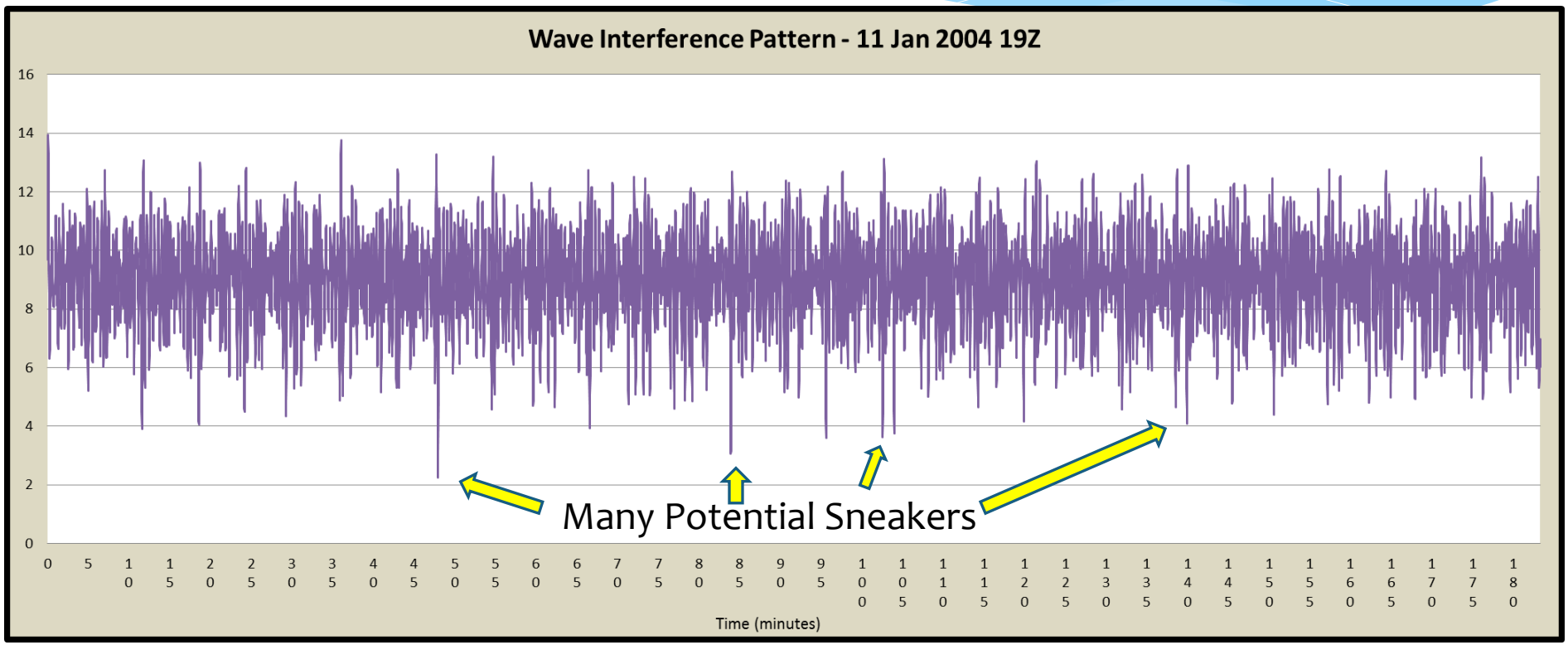
But there are other cases that don't fit the "Classic" mold

Like this fatality case in Mendocino County CA…





The Wave Interference Pattern showed possible Sneaker Waves



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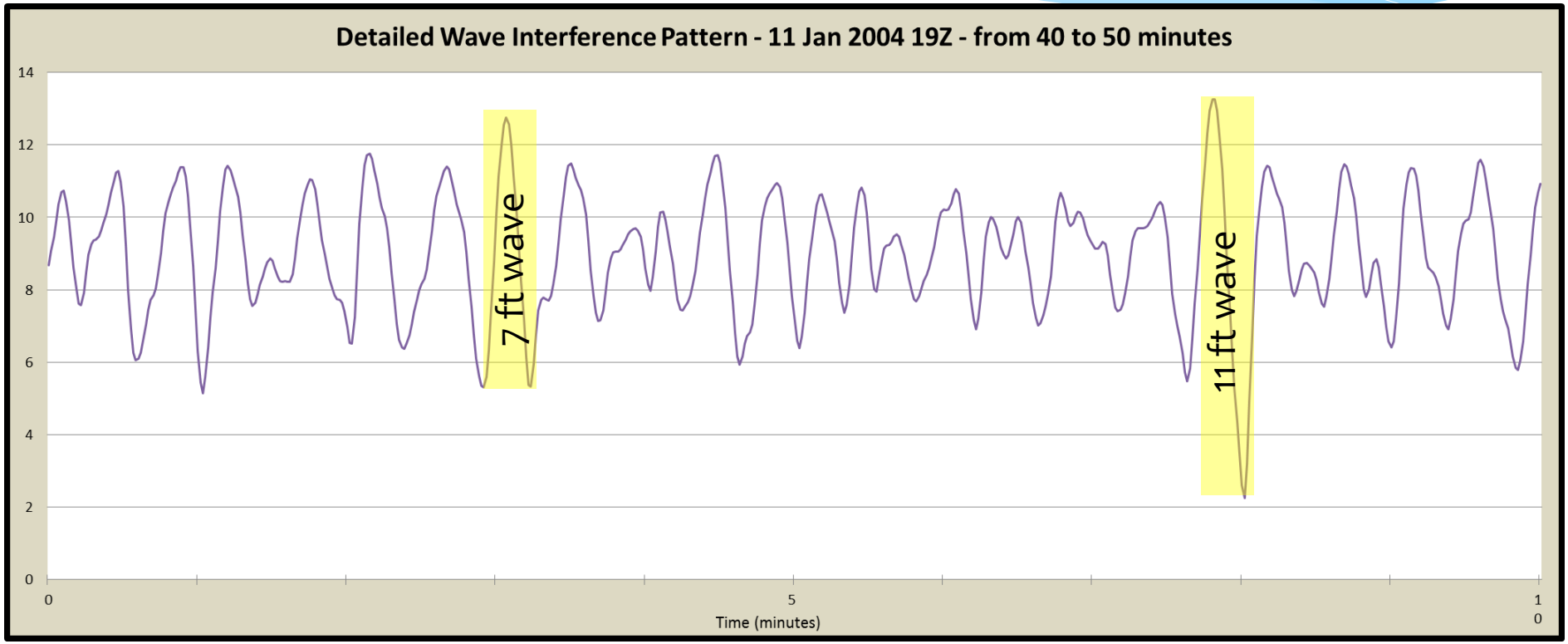
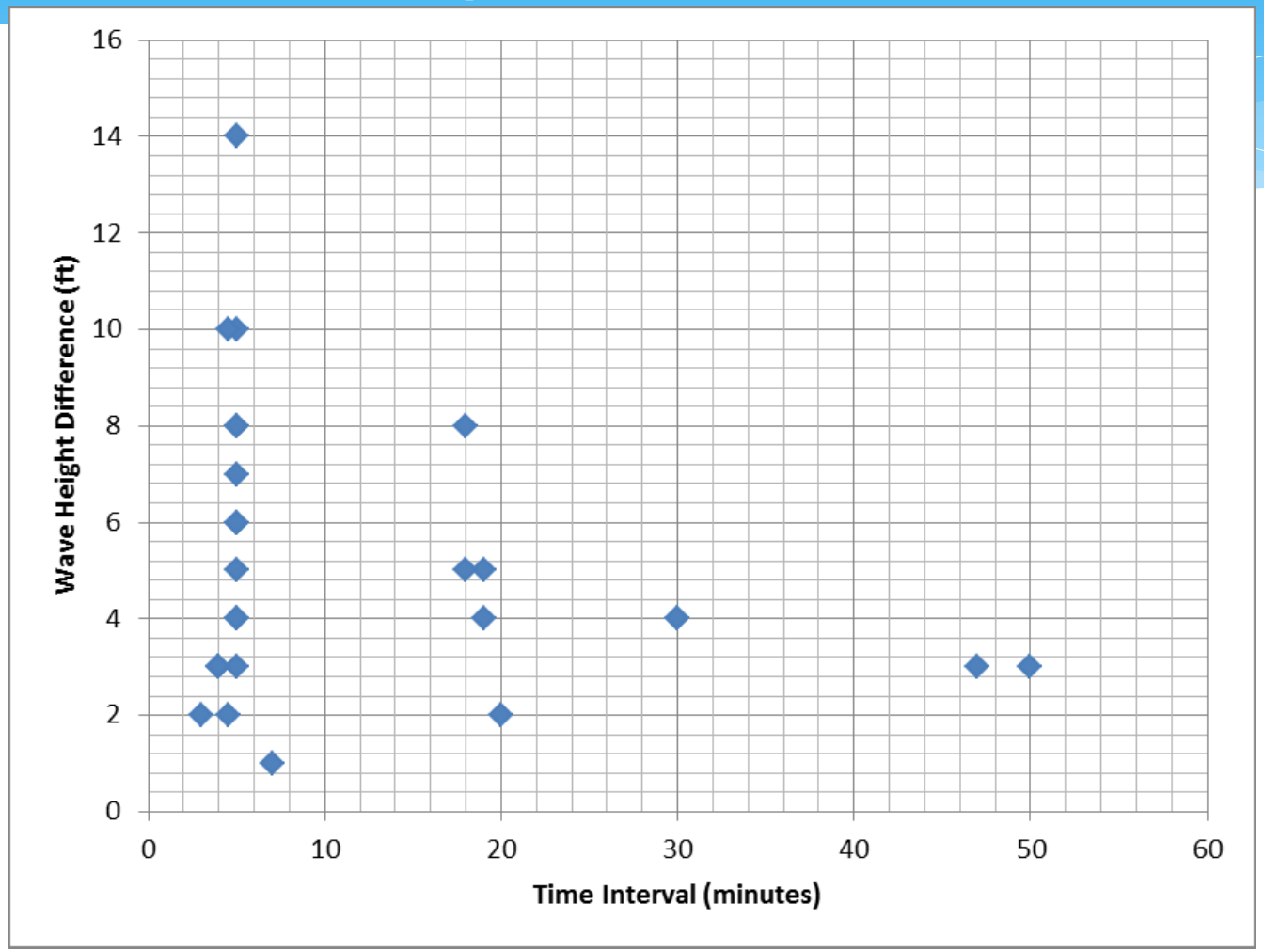


An Analysis of 23 Reported Sneaker Waves using Wave Interference



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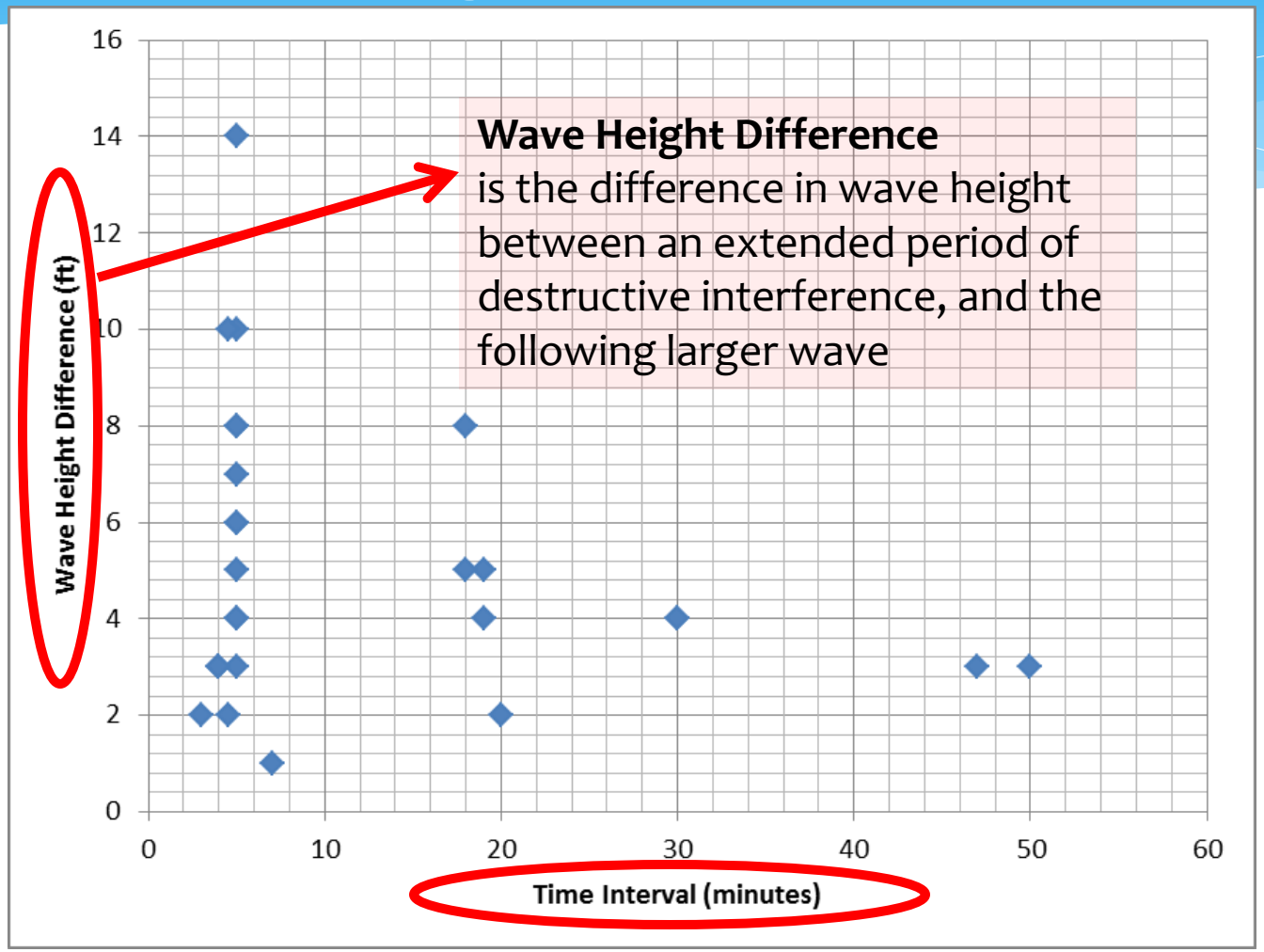

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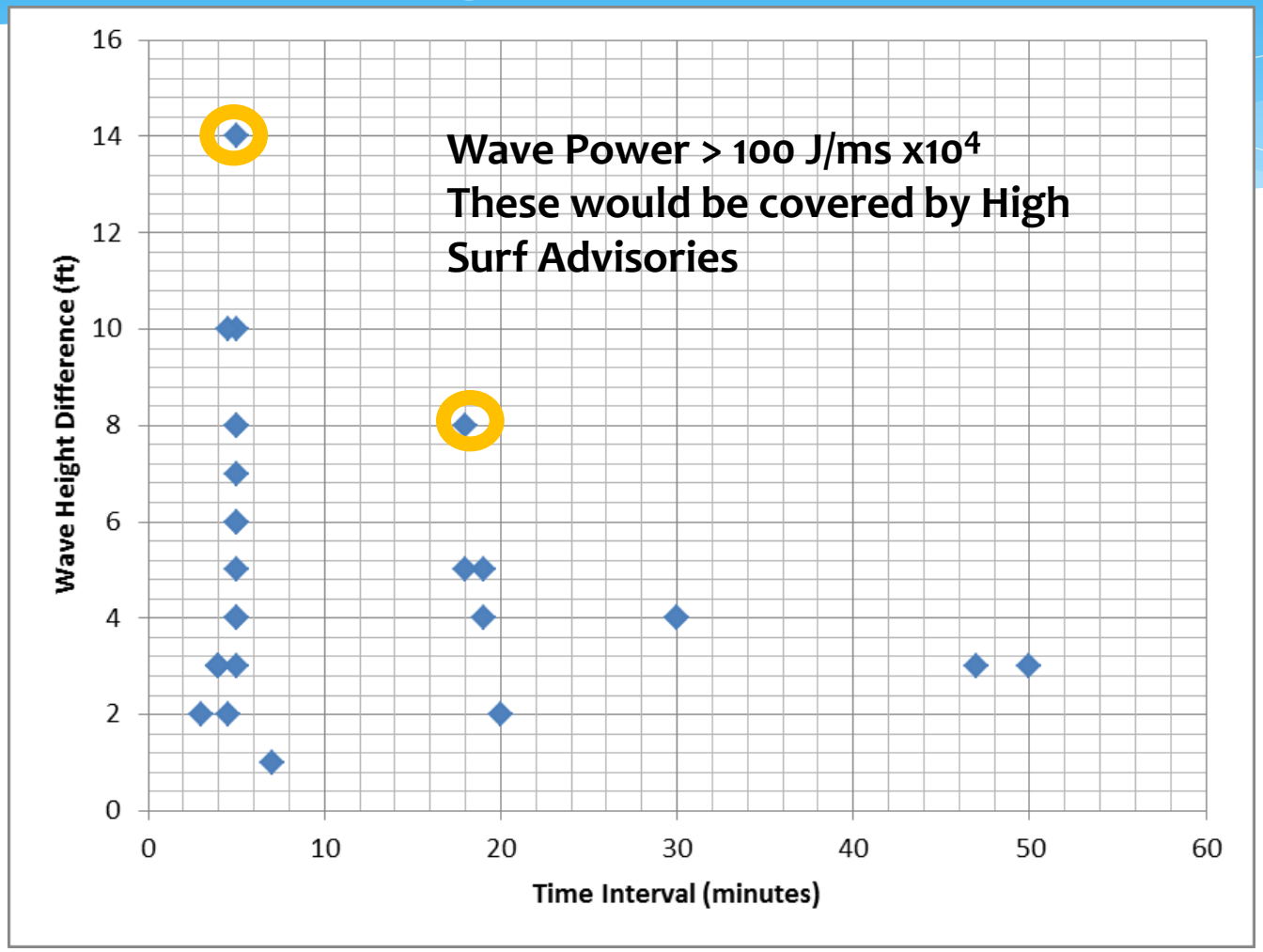

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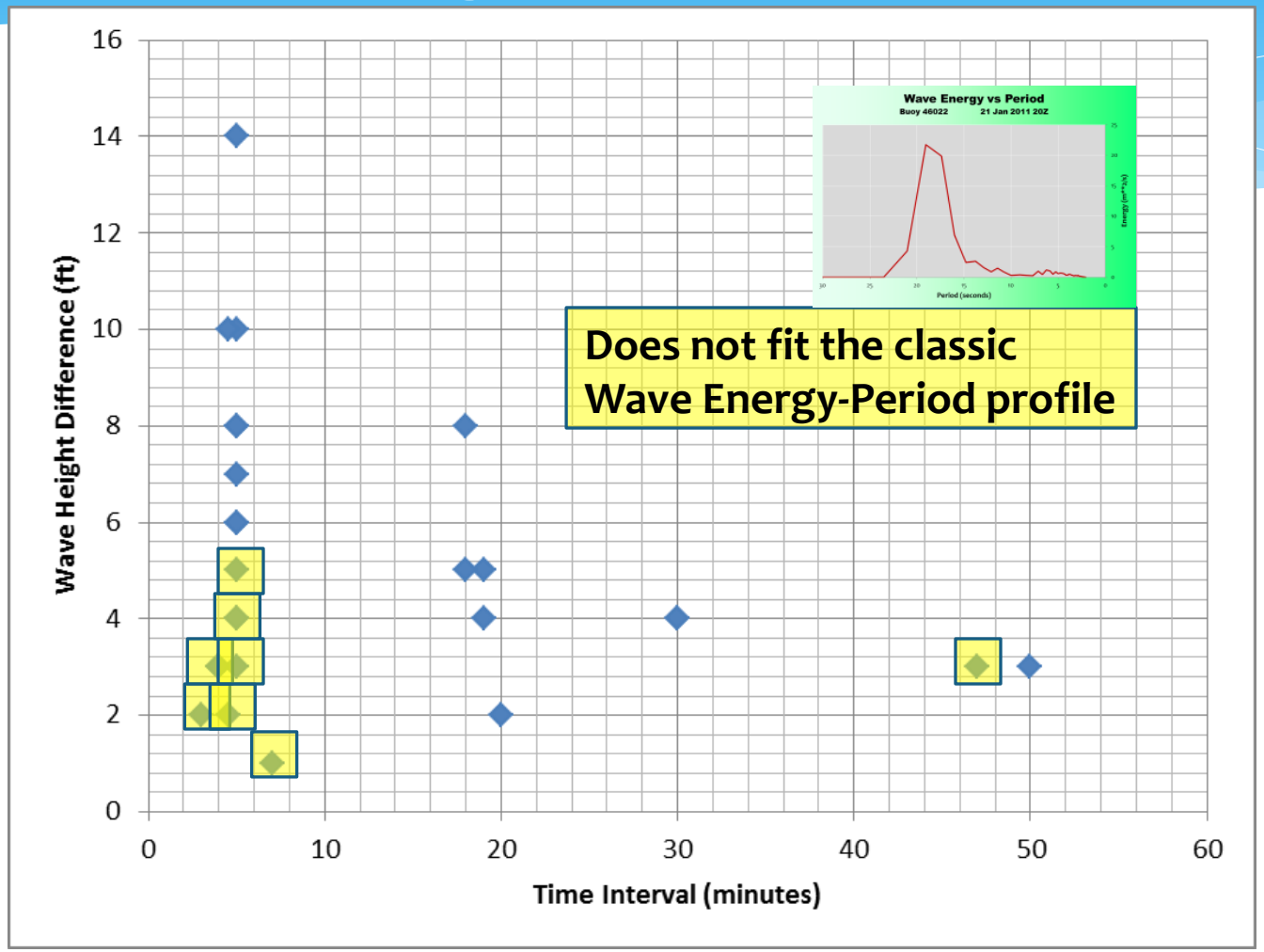

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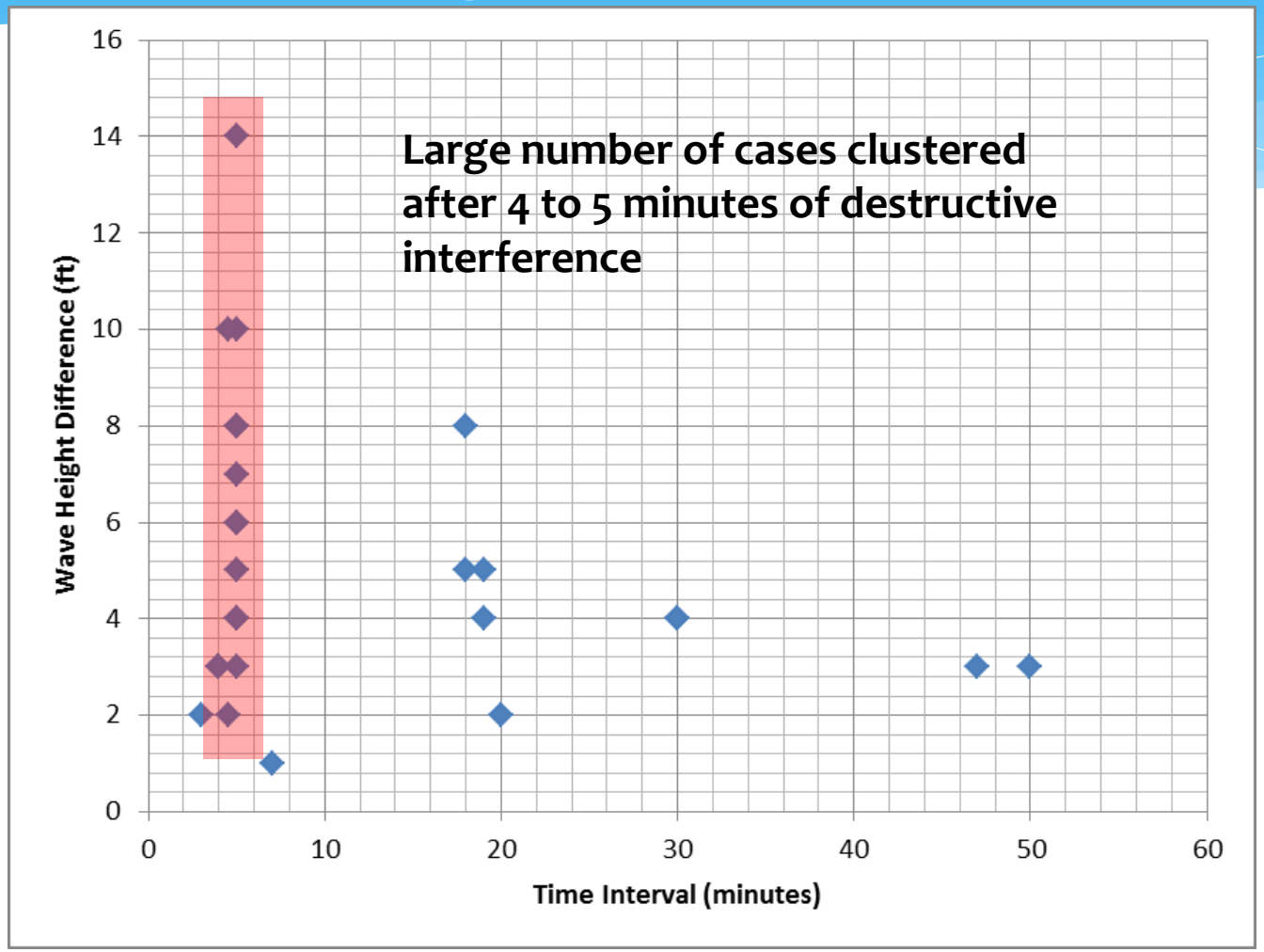

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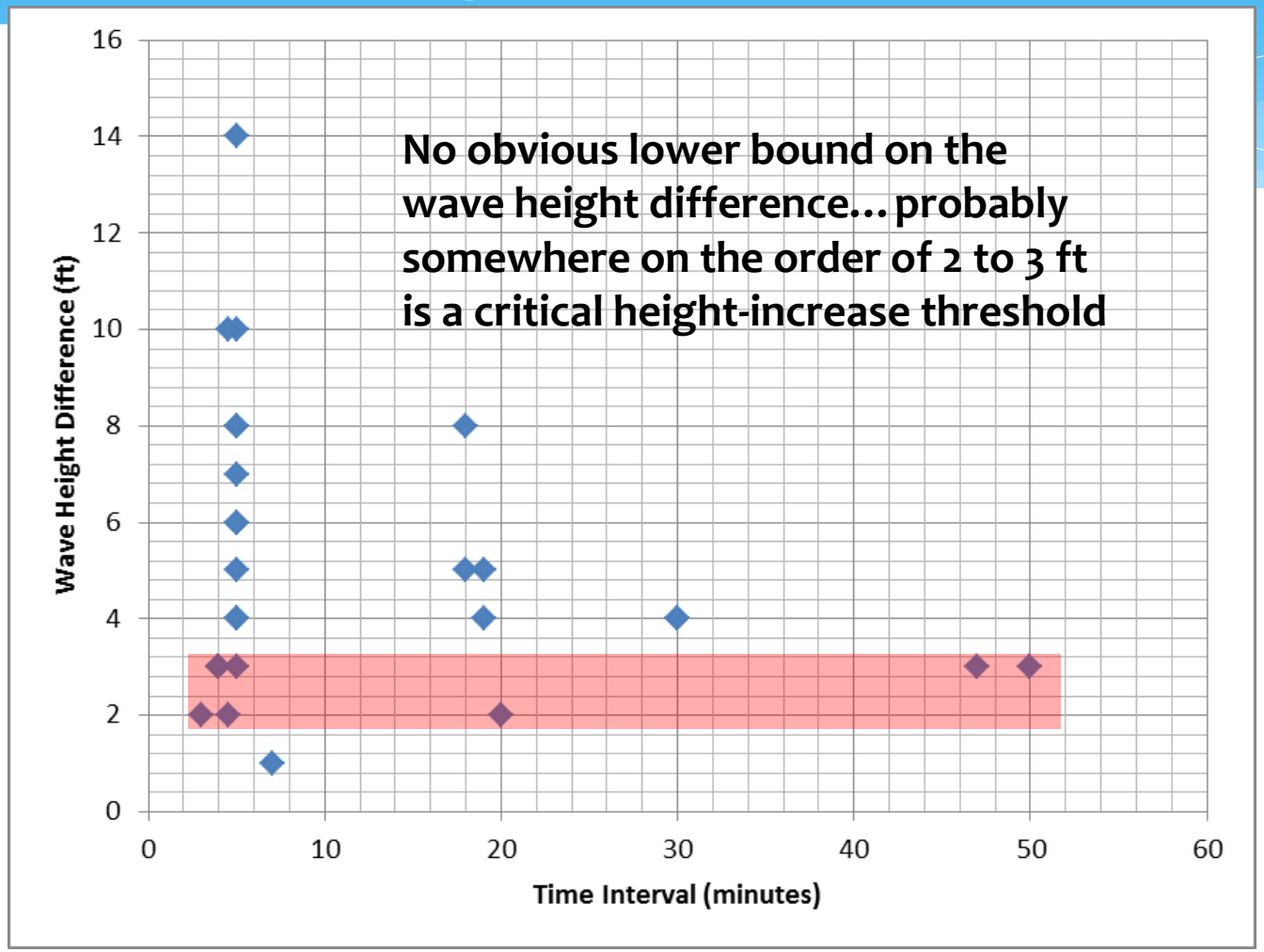


Putting a number on it

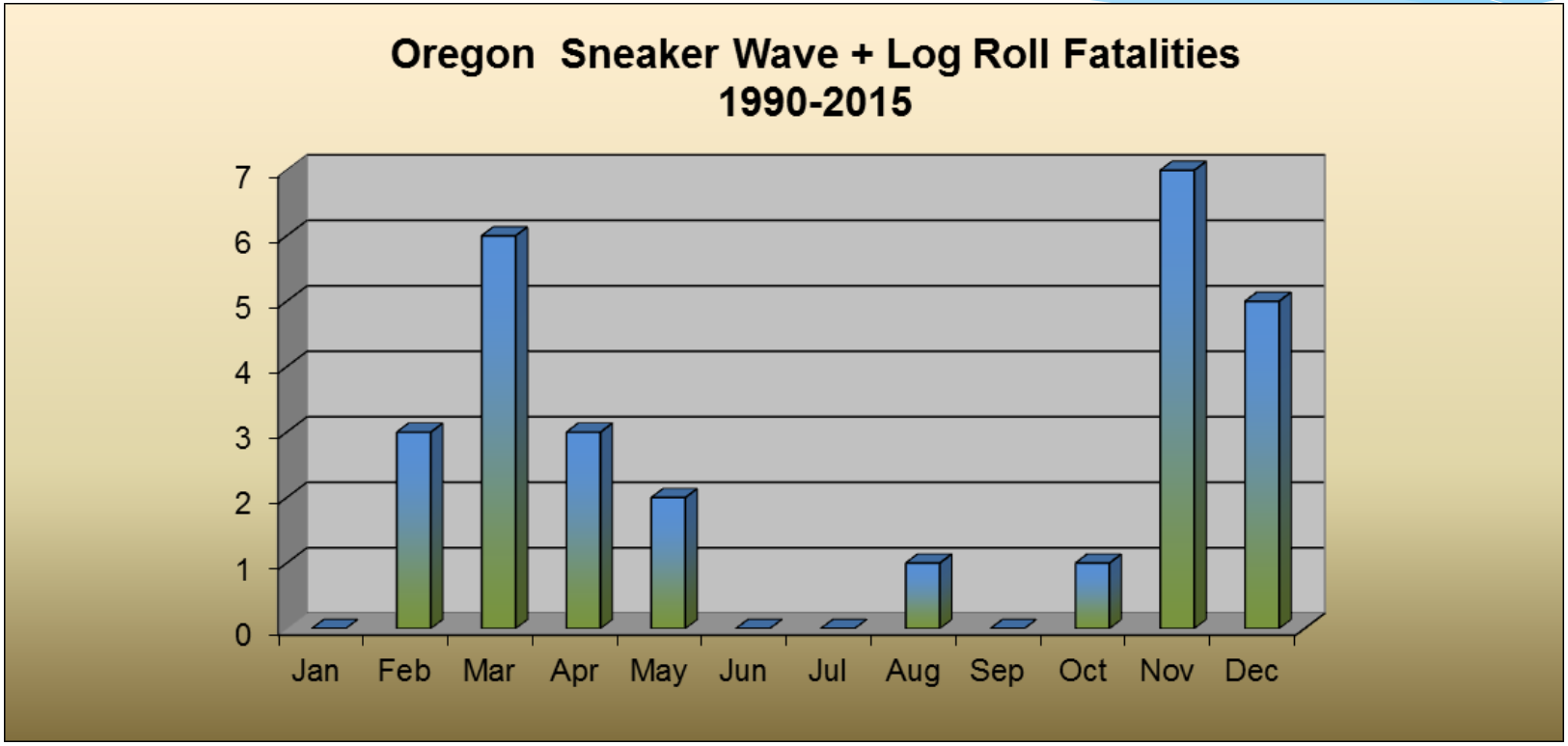
Greatest Height increase can be classified for public consumption:

< 2 ft	**Low** threat of Sneaker Waves
2 to < 3 ft	**Moderate** threat of Sneaker Waves
3 to < 4 ft	**High** threat of Sneaker Waves
≥ 4 ft	**Very High** threat of Sneaker Waves

Sneaker Wave Threat: **Moderate**

Sneaker Heights up to: **2.6 ft**

When do Sneaker Wave deaths occur?



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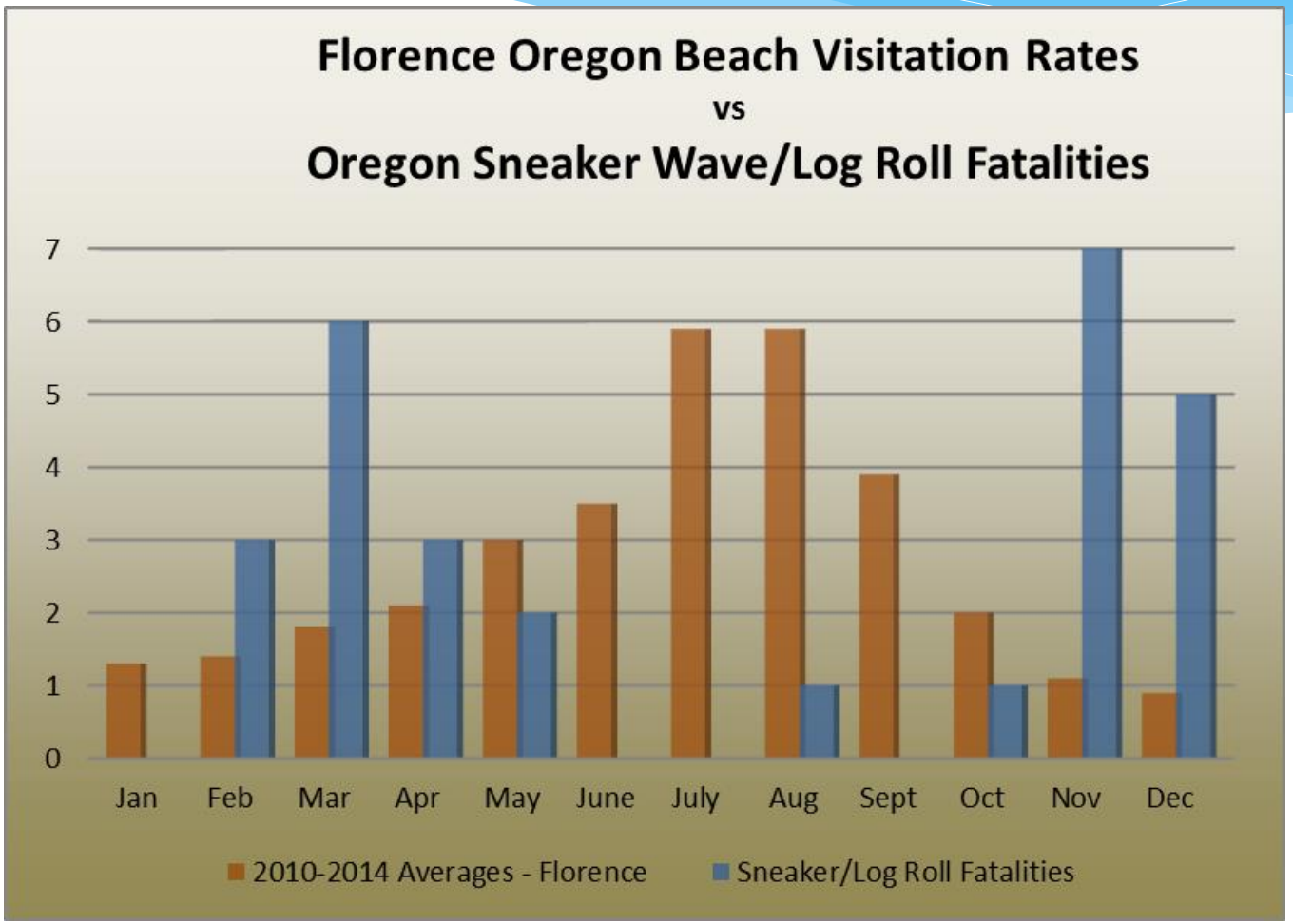

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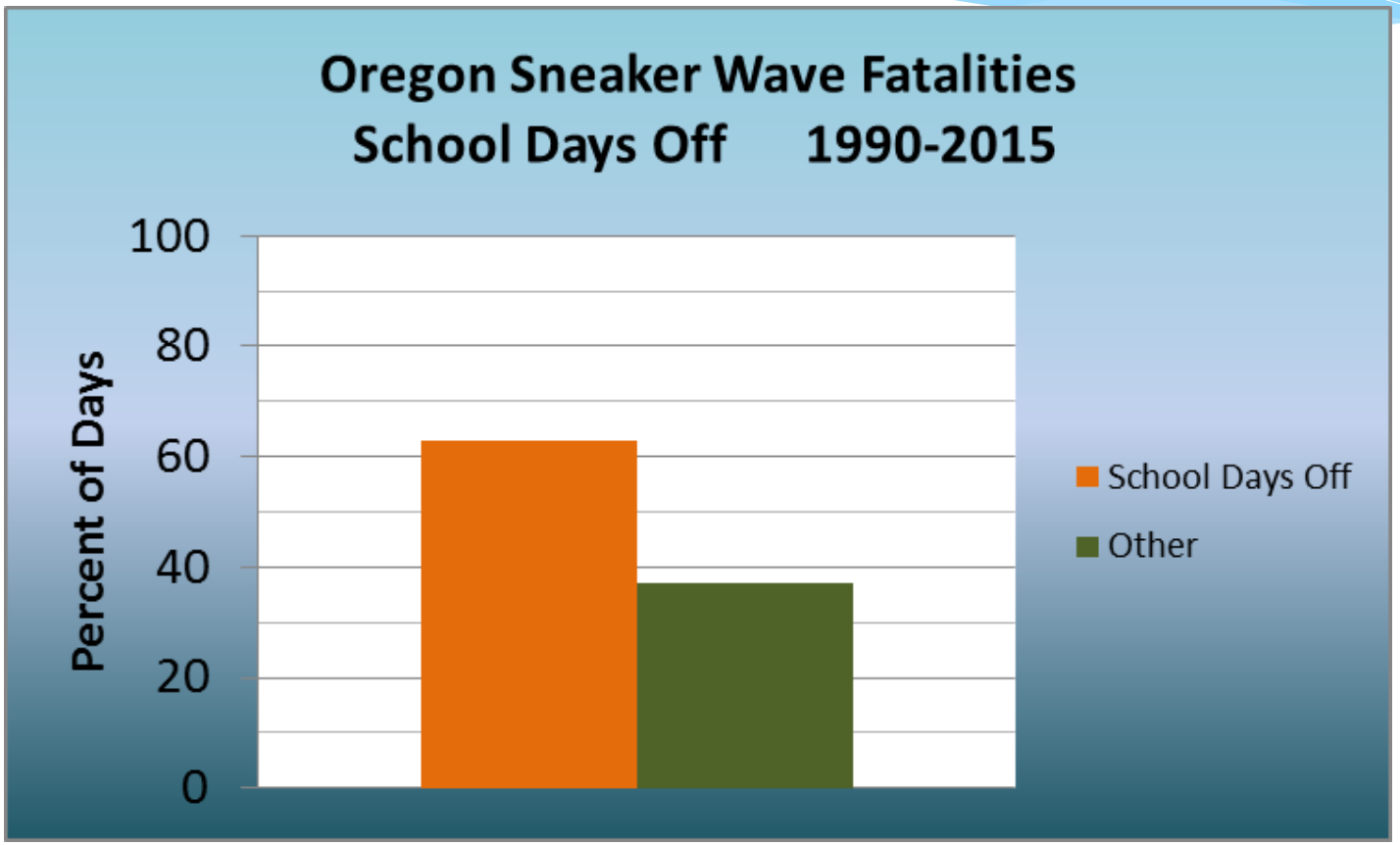

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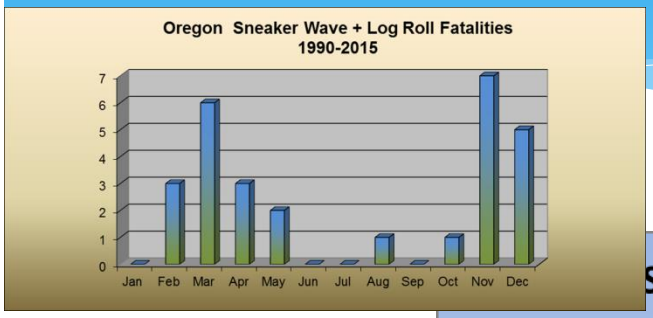

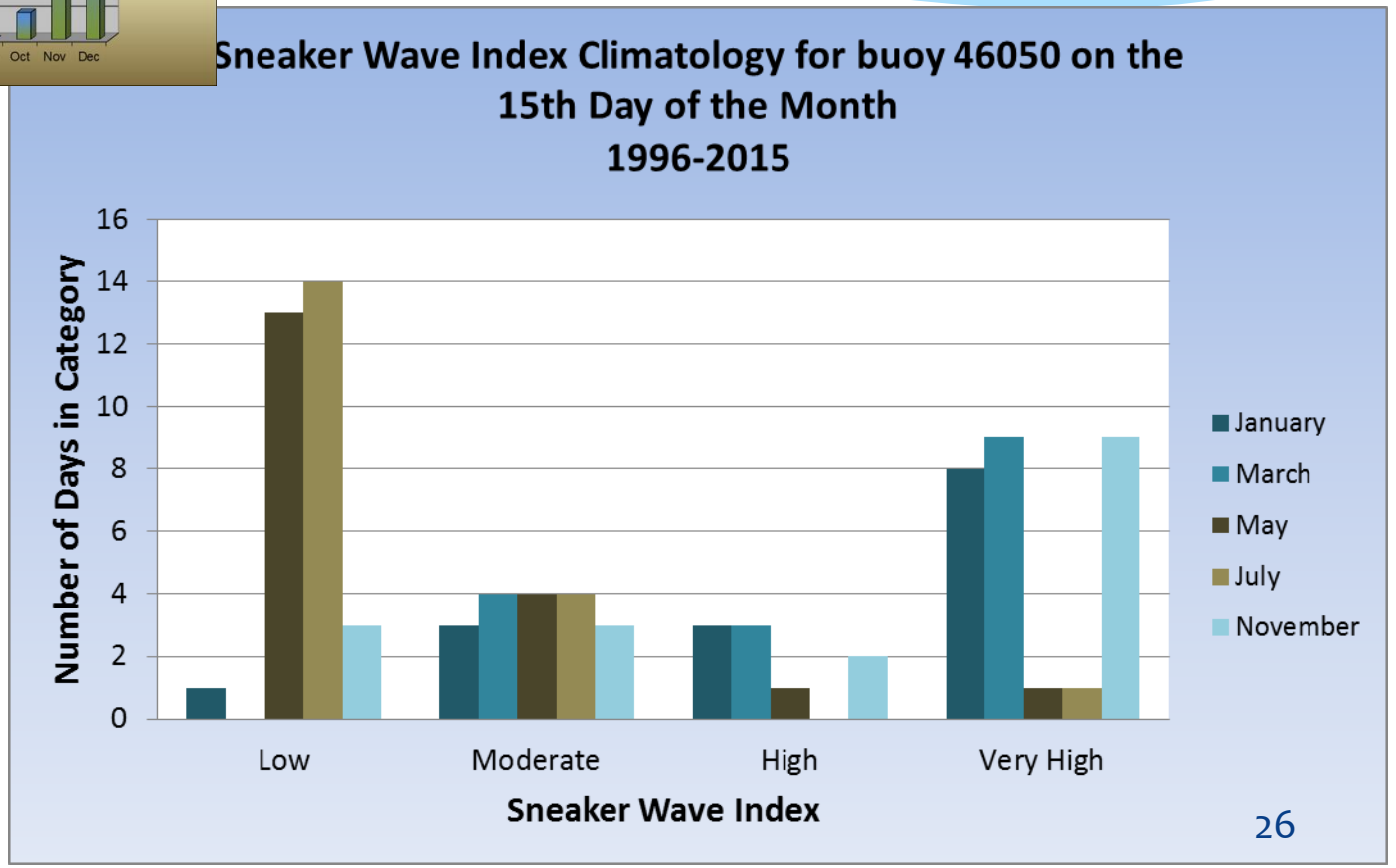

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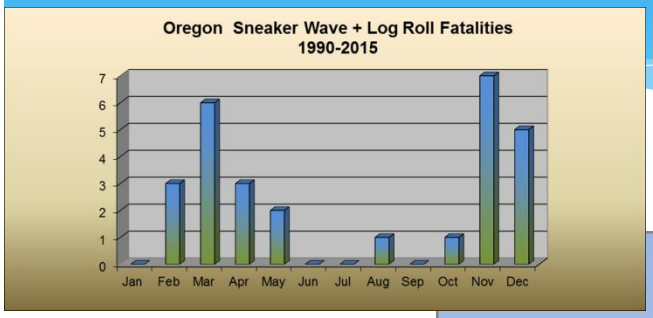
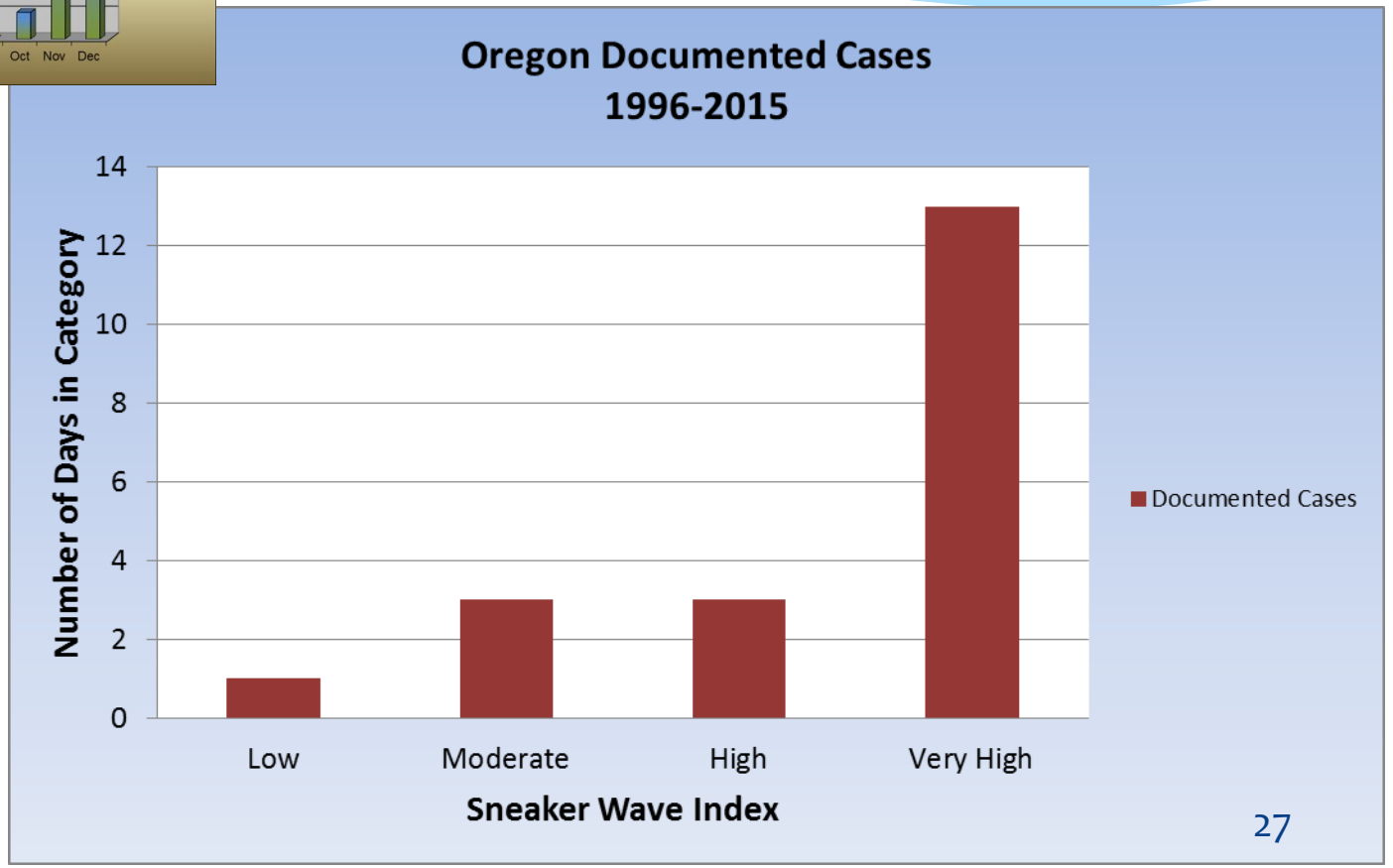
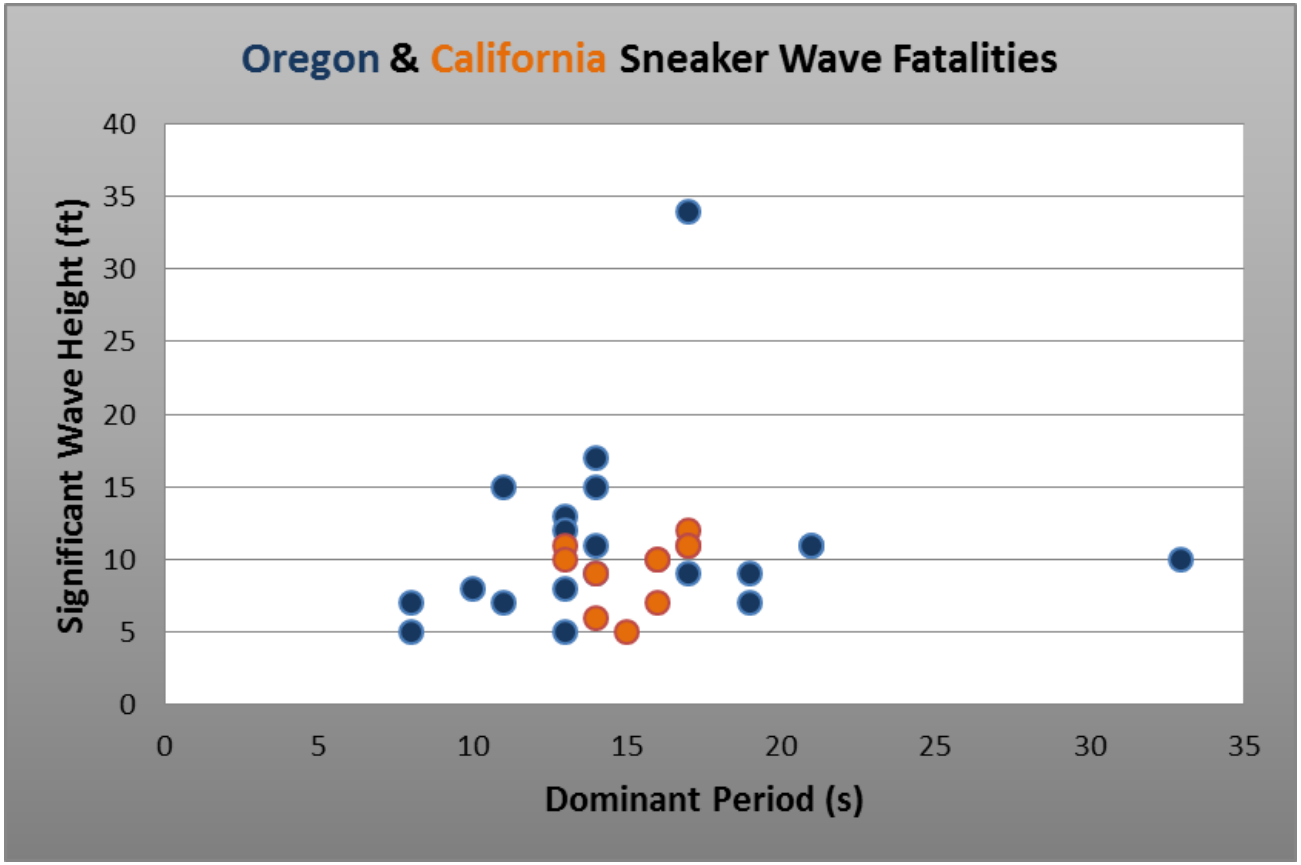




What about other areas?

Washington: *No known fatalities*

California: *Only reports are from central and northern coast*



Shortcomings

Not a direct measurement of sneakers

Shortcomings

It is a deep-water wave

Shortcomings

It does not include beach geography

Shortcomings

It does not factor in wave run-up

Shortcomings

It does not include human behavior factors

Thank you

Image: www.flickr.com/photos/sneakerphotography/3231914523

So how are the Wave Interference Charts generated?

Given NDBC Spectral Wave Density Data:

f = frequency (1/s)

E = Energy (m^2/s)

bw = bandwidth(s) = f_2-f_1

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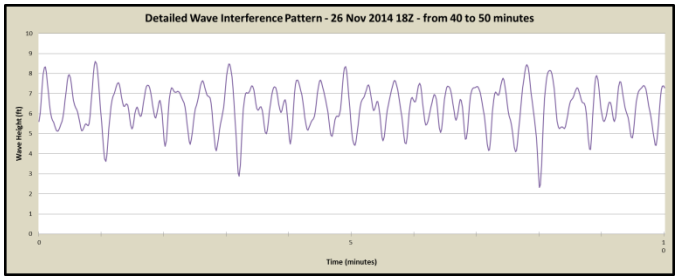
Calculations are made at 1 second intervals in Excel, using a sine function. All bins can then be combined into a single deep-water wave height.

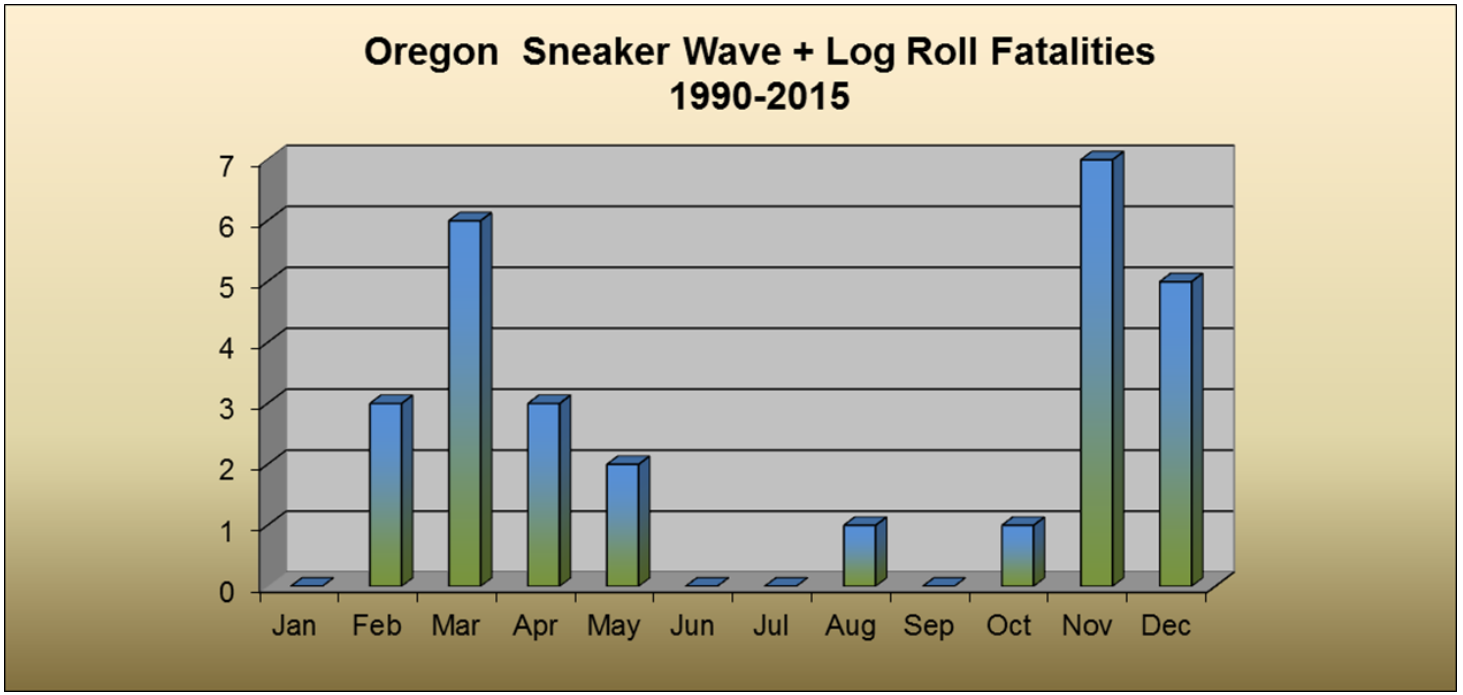


Shortcomings

Currently only a diagnostic tool

How often do Sneaker Waves Occur?

Recall…



How often do Sneaker Waves Occur?

Sneaker Wave Index	Late Spring to Early Fall (May/July)	Late Fall to Early Spring (Nov/Jan/Mar)
Very High	5 %	54 %
High +	8 %	71 %
Moderate +	29 %	92 %